A DISSERTATION ON

EVALUATION OF MODIFIED ALVARADO SCORING SYSTEM

IN ACUTE APPENDICITIS

Dissertation Submitted in partial fulfillment of

M.S. DEGREE EXAMINATION

M.S. GENERAL SURGERY—BRANCH I

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CERTIFICATE

This is to certify that this dissertation titled **"EVALUATION OF MODIFIED ALVARADO SCORING SYSTEM IN ACUTE APPENDICITIS"** has been prepared by Dr.A.P.DEEBAPRIYA under my supervision in the Department of General surgery,Chengalpattu Medical College, Chengalpattu during the academic period 2007-2010 and is being submitted to the Tamil Nadu DR.M.G.R. Medical University, Chennai in partial fulfillment of the University regulation for the award of the Degree of Master of surgery(M.S.General surgery) and her dissertation is a bonafide work.

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DECLARATION

I, A.P.DEEBAPRIYA, solemnly declare that the dissertation "**EVALUATION OF MODIFIED ALVARADO SCORING SYSTEM IN ACUTE APPENDICITIS"** a bonafide work done by me in the Department of General surgery, Chengalpattu Medical College, Chengalpattu, under the able guidance of Prof.Dr.P.Ramanujam, Associate professor, Chengalpattu Medical College, Chengalpattu.

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I thank all the patients who took part in my study and their relatives.

CONTENTS

INTRODUCTION

Acute appendicitis remains one of the most common surgical diseases encountered. When appendicitis manifests in its classical form it is easily diagnosed & treated. Unfortunately these classic symptoms occur in one half of patients with acute appendicitis. Accurate & timely diagnosis of atypical appendicitis remains clinically challenging and one of the most commonly missed problems in the emergency department. Furthermore the consequence of missing appendicitis thus leading to perforation significantly increases morbidity & prolongs hospitalization.

AIM OF STUDY

To evaluate the value of MODIFIED ALVARADO SCORIING SYSTEM (MASS) as a diagnostic tool to aid early and accurate diagnosis of acute appendicitis.

MATERIALS AND METHODS

A prospective study was conducted from august 2007 to October 2009 in patients admitted with suspected acute appendicitis in the surgical wards of chengalpattu medical college hospital.

Patients with suspected acute appendicitis were assessed by Modified alvarado scoring system.

Age group comprised of 10 years to 70 Years. Both sexes were included. Patients included in the study were haemodynamically stable without any concurrent illness.

Thorough clinical examination was done along with total leucocyte count.

REVIEW OF LITERATURE

HISTORICAL REVIEW

The appendix was probably first noted as early as the Egyptian civilization (3000 B.C.) During the mummification process, abdominal parts were removed and placed in Coptic jars with inscriptions describing the contents. When these jars were uncovered inscriptions referring to the “worm of the intestine” were discovered.

Aristotle and Galen did not identify the appendix because they both dissected lower animals. Which do not have appendices. Celsus, however, probably discovered the appendix because he was allowed to dissect criminals executed by caeser.

Leonardo Da vinci first depicted the appendix in anatomic drawings in 1472.

In 1521 Jacopo beregari da Capri a professor of anatomy in bologra identified the appendix as an anatomical structure.

In 1500, Vesalius (1343) and Pare (1582) Referred to the appendix as the Caecum.

Laurentine Compared the appendix to a twisted worm in 1600, phillipe coined the term appendix vermiformis in 1710.

In 1886 Reginald H. Fitz a Harvard pathologist first described the clinical condition of acute appendicitis. He correctly pointed out the importance of its

early diagnosis and timely treatment based on his analysis of 257 cases of perforating inflammation of the appendix and 209 cases of typhilitis (or) Perityphilitis (Fitz, 1886), A few yrs later, Charles Mcburney described the clinical findings prior to rupture and advocated early surgical intervention. Despite aggressive intervention, mortality & morbidity rates remained high throughout the rest of the 19th century and the first half of 20th century.

The mortality rates associated with appendicitis declined with the introduction of antibiotic, with the development of anesthesia and better preoperative care.

1492

Leonardo da vinci clearly depicted the organ in his anatomical drawings.

1521

Berengario Da Capri first described the organ.

1530

Vidovidius first named the worm like organ as the vermiform appendix.

1543

Andrews Vesalius well illustrated in 'De humani corporis fabrica'

1711

Lorenz Heister gave the first good description of a case of acute appendicitis in a post mortem of an executed criminal

1735

Claudius Amyand performed the first recorded successful appendicectomy, the appendix perforated by a pin and surrounding omentum were removed through a scrotal wound while dealing with a faecal fistula in a 11 yr old boy.

1767

John Hunter described a gangrenous appendix at postmortem

1812

John Parkinson first described a faecolith in a perforated appendix at postmortem.

1827

Francois Melier suggested the possibility of appendicectomy as an operation. Dupuytren opposed this.

1839

Bright and Addison published a medical textbook clearly out lining the symptomatology of acute appendicitis. Hodgkin agreed.

1850

On wards, anesthesia took off, perityphylitis abscesses drained - Hancock (1848) Willard parker (1867) & others (1870 s)

1867

Joseph lister gave his first paper on ‘antisepsis’

1880

Lawson Tait operated with the express intent of performing appendicectomy having made a preoperative diagnosis of disease of the organ.

1883

Abraham Groves of Ontario did likewise

1884

Mikulicz in Krakow recommended and performed surgery for appendicitis, kronlein in Germany did likewise.

1885

Charter Symonds, an Englishman performed the first interval operation for acute appendicitis but did not remove the appendix.

1886

Hall of Nework in May performed appendicectomy but had not commenced the operation with such intent.

1887

Sir Frederick Treves of London unkinked an appendix in February of that year. Morton,seven yrs after Tait in England and 4 yrs after Groves in Canada in April of that year performed the first deliberated appendicectomy for appendicitis in U.S

1888

On wards for a decade brought improvement of technique Treves, Sem,

Mcburney, Weir, Worcester, Fowler, Deaves marcy and Richardson

1894

July- Mcburney outlined the grid iron incision and named his ‘point’

1902

Oschner and sherren suggested a conservative regimen to prevent infection spreading, making subsequent surgery safer.

1904

Murphy reported 2000 appendicectomies between 1880 and 1903 mostly being what we call ‘Interval appendicectomy’ and named his triad (Pain, vomiting & RIF tenderness).

1905

Rockey described a transverse skin incision which Elliot had done in 1896

1906

Davis, Harrington, weir & Fowler all wrote on appendicectomy

It has been claimed that diagnostic aids can dramatically reduce the number of negative appendicectomies, the number of perforations and the time spent in the hospital.

The methods advocated include laparoscopy, scoring systems, ultrasonography, computed tomography and Magnetic resonance imaging.

ALVARADO in 1986 proposed his scoring system to diagnose acute appendicitis on the basis of certain clinical parameters and investigations. He suggested operations for score 7 or above out of 10.

Later it was modified by KALEN ET AL who excluded one variable from the original Alvarado, so that the total score becomes 9.

Its usefulness in reducing the rate of negative appendicectomies has been established and refuted in different studies.

EMBRYOLOGY OF VERMIFORM APPENDIX

Only a few Diverse Mammals Possess an Appendix.

In a study of the alimentary tract of animals, we find the appendix is not present in any invertebrate. Among the vertebrate, it is absent in fish, amphibians, reptiles, birds and most mammals. Infact, the vermiform appendix, recognized as a worm-like, narrow extension beginning abruptly at the caecal apex is only present in a few Marsupials Such as the wombat and south American Opossum, a few rodents (rabbits and rats) and few primates (only the anthropoid apes and man). Note that monkeys do not have such an organ.

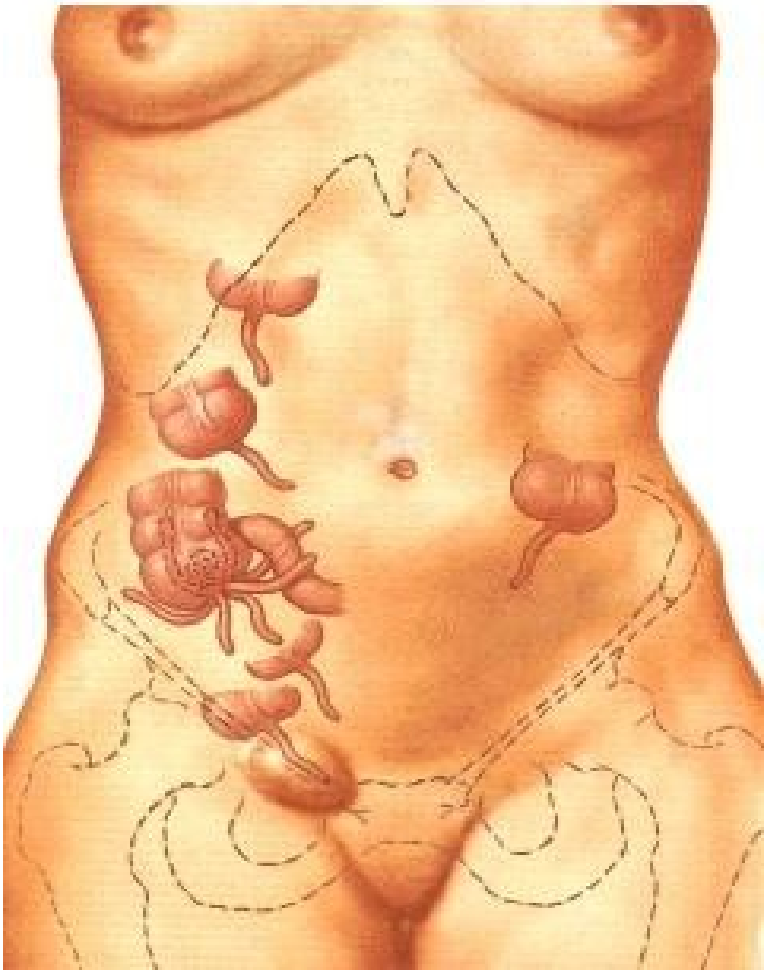
Caecum and appendix develop from the caecal bud as a diverticulum that arises from the post arterial segment of mid gut loop. The proximal part of the bud grows to form the caecum. It’s distal part remains narrow and forms the appendix. During the greater part of fetal life the appendix arises from the apex

of Caecum. Subsequently the lateral wall of the Caecum grows much more rapidly than the medial wall with the result the point of attachment of appendix comes to lie on medial side into a retrocaecal and intraperitoneal position.

Rarely the caecum does not migrate during development to its normal position in the right lower quadrant of abdomen. In such cases, we come across a sub-hepatic appendix or situs inversus totalis,in which the appendix is in the left iliac fossa, causing diagnostic difficulty if appendicitis develops.

VARIATION IN POSITION IN APPENDIX

Variation in position in appendix



ANATOMY

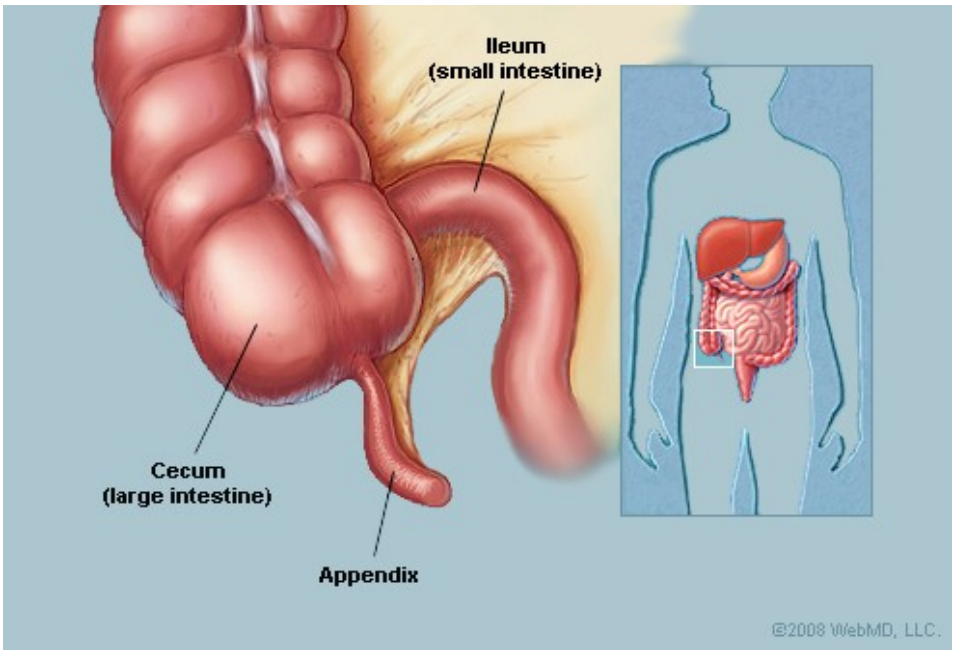
The appendix averages 10 Cms in length but can range from 2-20Cms. The wall of the appendix consists of 2 layers of muscle, an inner circular and

outer longtitudinal. The longtitudinal layer is a continuation of the taenia coli. The appendix is lined by colonic epithelium.

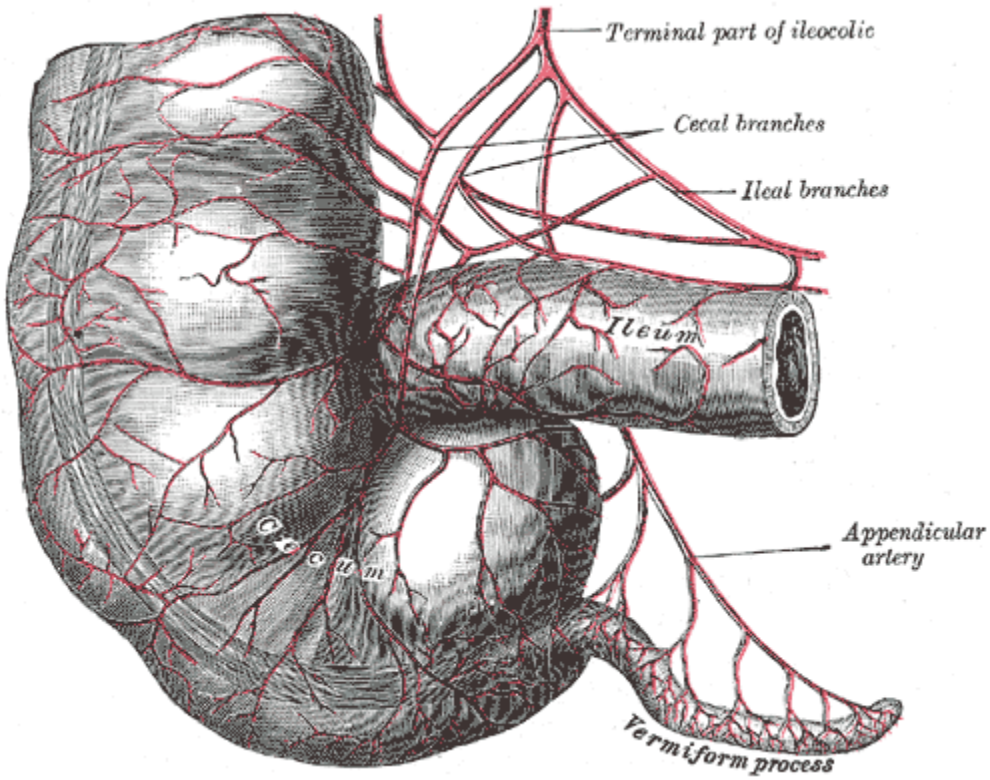
Few submucosal lymphoid follicles are noted at birth. These follicles enlarge, peak from 12-20years and then decrease. This correlates with the incidence of appendicitis.

Blood supply to the appendix is mainly from the appendicular artery,a branch of the ileocolic artery. This artery courses through the mesoappendix posterior to the terminal ileum. An accessory appendicular artery can branch from the posterior caecal artery. This artery can lead to significant intra operative and post operative hemorrhage and should be searched for carefully and ligated once the main appendicular artery is controlled. The base of the appendix is fairly constant and is located at the posteromedial wall of the caecum about 2.5cms below the ileocaecal valve this is also where the taeniae converge. The base is at a constant location, whereas the position of the tip of the appendix varies. In 65% of patients, tip is located in a retrocaecal position, in 30% it is located at the brim or in the true pelvis; and in 5% it is extraperitoneal, situated behind the caecum, ascending colon or distal ileum. The location of the tip of the appendix determines early signs and symptoms.

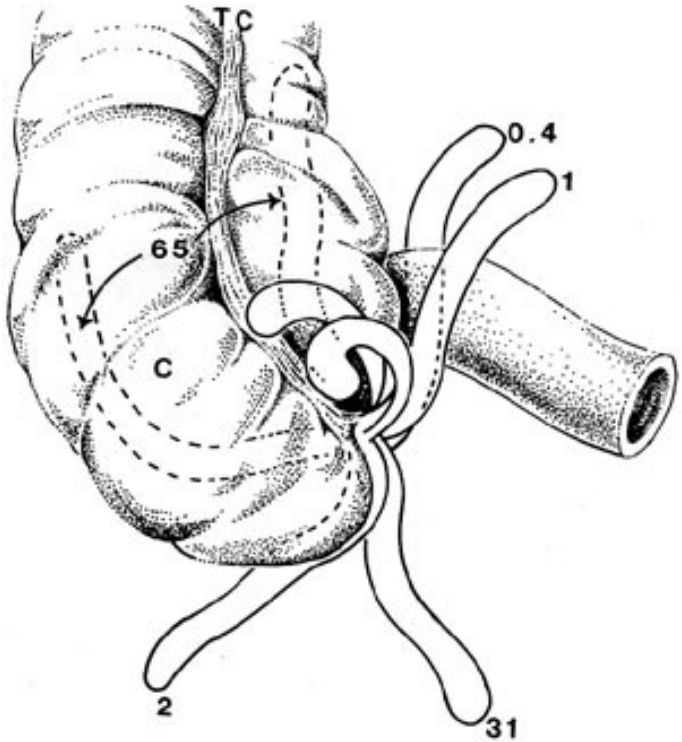
ANATOMY OF APPENDIX



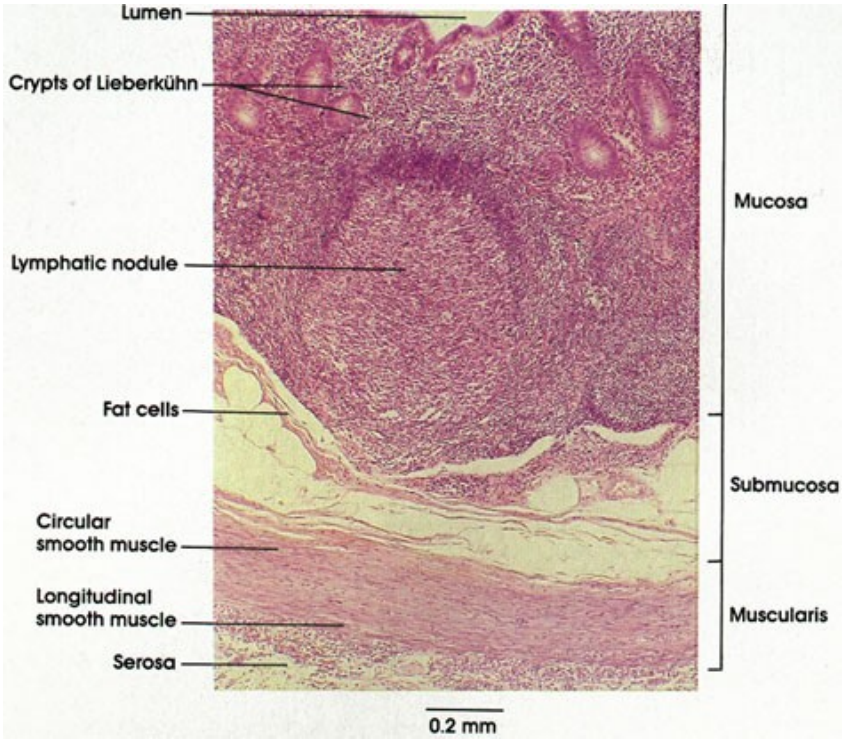
BLOOD SUPPLY OF APPENDIX



POSITION OF APPENDIX



HISTOLOGY OF APPENDIX



AETIO PATHOGENESIS

Appendicitis results from the obstruction of the lumen of the appendix. Obstruction may be from lymphoid hyperplasia (60%), faecolith, faecal Stasis (35%), foreign body (4%) and tumours (1%).

The basic pathophysiology of appendicitis is obstruction of the lumen of the appendix followed by infection. In 60% of patients obstruction is caused by hyperplasia of the submucosal follicles. This form of obstruction is mostly observed in children and is known as' **catarrhal appendicitis'**.

A faecolith or faecal stasis causes luminal obstruction in 35% of the time and is usually observed in adults. Obstruction may also be caused by foreign bodies (4%) and tumours (1%).

Following obstruction, an increase in the mucus production occurs, and this leads to increased pressure. With increased pressure and stasis from obstruction, bacterial overgrowth ensues. The mucus then turns into pus that causes a further increase in intraluminal pressure. This leads to distension of the appendix and visceral pain, which is typically located in the epigastric or periumbilical region.

As the luminal pressure continues to increase, lymphatic obstruction occurs leading to an oedematous appendix. This stage is known as **‘acute or focal appendicitis’**. The overlying peritoneum becomes irritated, and the pain now localized to the right lower quadrant (RLQ). This series of events results in the classic migrating pain described in patients with appendicitis.

Further increase in pressure leads to venous obstruction,causing oedema and ischaemia of the appendix. At this stage bacterial invasion of the wall of the appendix occurs and is known as **‘acute Suppurative appendicitis**.’ Finally with continued pressure increases, venous thrombosis and arterial compromise occurs, leading to **‘Gangrene and perforation**.’ If the body successfully walls off the perforation, the pain may actually improve. However, symptoms do not completely resolve. Patients may still have underlying right lower quadrant pain, decreased appetite, Change in bowel habits, or intermittent low Grade fever. If the perforation is not successfully walled off, then **‘diffuse peritonitis’** will develop.

CLINICAL PRESENTATION

Symptoms:

Abdominal pain is the most common symptom of appendicitis. In multiple studies, Specific Characteristics of the abdominal pain and other associated symptoms have proved to be reliable indicators of acute appendicitis (Table 1), A thorough review of the history of the abdominal pain and of the patients recent genitourinary, gynecologic and pulmonary history should be obtained.

Anorexia, nausea and vomiting are the symptoms that are commonly associated with acute appendicitis. The classic history of pain beginning in the periumbilical region and migrating to the right lower quadrant occurs in only 50% of patients. Duration of symptoms exceeding 24 to 36 hours is uncommon in non perforated appendicitis.

TABLE 1

COMMON SYMPTOMS OF APPENDICITIS

Common Symptoms	Frequency %
Abdominal pain	100
Anorexia`	100
Nausea	90
Vomiting	75
Pain migration	50

- Onset of symptoms occurs typically within the past 24 to 36 hours

SIGNS:

Right lower quadrant tenderness to palpation is the most important physical examination finding, other signs may help to confirm the diagnosis (Table 2). The rebound tenderness, which is associated with peritoneal irritation, is shown to be more accurately identified by percussion of the abdomen than by palpation with quick release.

As previously noted, the location of the appendix varies. When the appendix is hidden from the anterior peritoneum, the usual symptoms and signs of acute appendicitis may not be present. Pain and tenderness can occur in a location other than the right lower quadrant. A retrocaecal appendix, a retroperitoneal location may cause flank pain. In this case, stretching the iliopsoas muscle can elicit pain. The **Psoas sign** is elicited in this manner: The patient lies on the left side while the examiner extends the patient's right thigh. In contrast, a patient with pelvic appendix may show no abdominal signs, but the rectal examination may elicit tenderness in the cul-de-sac.

In addition an **obturator sign** (Pain on passive internal rotation of the flexed right thigh) may be present in a patient with a pelvic appendix.

TABLE 2

COMMON SIGNS OF APPENDICITIS

- Right lower quadrant pain on palpation (the single most important sign)
- Low-grade fever (38c), absence of fever or high fever can occur.
- Peritoneal signs
- Localised tenderness to percussion
- Guarding
- Other confirmatory peritoneal signs (absence of these signs does not exclude appendicitis)
- **Cope's Psoas test**– Pain on extension of right thigh (retroperiotoneal retrocaecal appendix)
- **Obturator sign** – pain on internal rotation of the Right thigh (pelvic appendix)
- **Rovsing's Sign** – pain in the right iliac fossa on pressing the left iliac fossa, is due to shift of bowel loops which irritates the parietal peritoneum
- **Dunphy's Sign** – Increased right iliac fossa pain with coughing
- Flank tenderness in right lower quadrant (retroperitoneal retrocaecal appendix)
- Patient maintains hip flexion with knees drawn up for comfort.
- **Aaron sign-** a sensation of epigastric pain and distress on pressure over Mcburney's point
- **Alder's sign-**.To diagnose acute appendicitis in pregnancy. Mark the most tender spot, then on turning the patient to left side, tenderness of uterine origin will shift while appendicular pain remain in the same point.
- **Blumberg sign-**Release sign-It is a sign of peritonitis due to presence of an inflamed organ underneath it .
- **Murphy's triad-**Pain in right iliac fossa,Vomiting,Temperature

DIFFERENTIAL DIAGNOSIS

Differential Diagnosis of Acute Appendicitis:

Gastrointestinal	Gynaecologic	Pulmonary
Cholecystitis	Ectopic Pregnancy	Pleurisy, Pneumonia (Basilar)
Crohn's disease	Endometriosis	Pulmonary
Diverticulitis	Ovarian Torsion	Infarction
Duodenal Ulcer	pelvic inflammatory disease	
Enteritis	Ruptured ovarian cyst	
		Genitourinary
Intestinal Obstruction	Tubo ovarian abscesses	Kidney stone
Intussusception	**Systemic**	Prostatitis
Meckle's diverticulitis	Diabetic ketoacidosis	
Mesenteric lymphadenitis	Porphyria	Pyelonephritis
Necrotising enterocolitis	Sickle cell disease	Urinary Tract infection
Neoplasm (Carcinoid, Carcinoma, lymphoma)		Parasitic infection
Omental Torsion		Psoas abscess
Pancreatitis		haematoma
Perforated viscus	Volvulus	

LAB AND RADIOLOGIC EVALUATION

LAB TESTS

Leukocytosis

Increase of C – Reactive protein

PLAIN X-RAY FILM

i. To elucidate the cause of abdominal pain

SIGNS OF ACUTE APPENDICITIS

a) Appendix calculus (0.5-6cm)

b) Sentinel loop – dilated atonic ileum containing a fluid level

c) Dilated caecum

d) Widening of the preperitoneal fat line

e) Right lower quadrant haze due to fluid and oedema.

f) Scoliosis concave to the Right

g) Right lower quadrant mass indenting the caecum.

h) Blurring of the right psoas outline – unreliable

i) Gas in the appendix – Rare, unreliable

ULTRASOUND IN ACUTE APPENDICITIS :

The graded compression technique for ultrasound examination was described by Julien puylaert in 1986.

Using a probe of at least 7 MHz over the point of maximum tenderness in the RIF, Pressure is gradually increased over the area in order to displace the bowel loops. The appendix may then be seen overlying the psoas muscle

ULTRASOUND SIGNS IN ACUTE APPENDICITIS

a) Blind ending tubular structure at the point of tenderness.

- Non compressible
- Diameter 7mm(or) greater
- No peristalsis

b) Appendicolith casting acoustic shadow

c) High echogenicity non compressible surrounding fat

d) Surrounding fluid or abscess

e) Oedema of caecal pole

False negative examinations

- Appendicitis of the appendiceal tip
- Retrocaecal appendicitis
- Gangrenous (or) perforated appendicitis
- Gas filled appendix

Perforated appendix may become compressible and if there is generalised peritonitis it may be difficult to perform the technique.

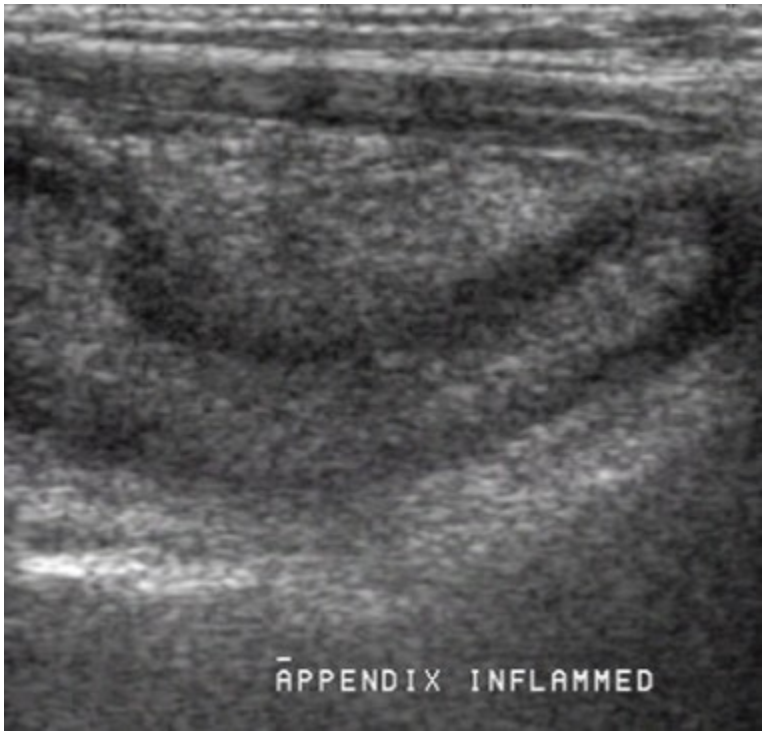
False positive Examinations:

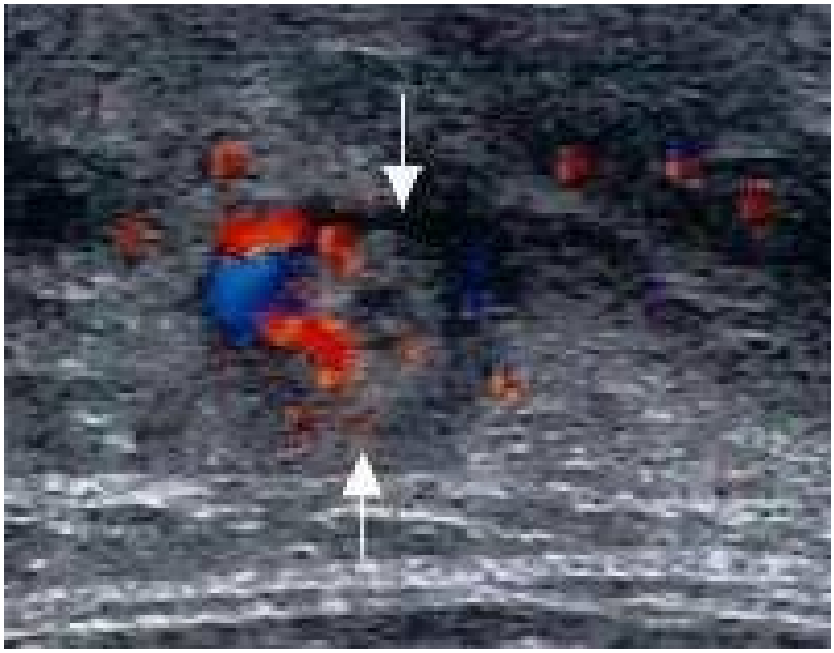
- Resolving appendicitis
- Dilated Fallopian tube

- Inflammatory Bowel disease
- Inspissated stool mimicking an appendicolith

Major drawback in the investigation is, Normal appendix is not visualized by these techniques. Although a positive diagnosis can be made when an abnormal appendix is seen appendicitis cannot be excluded when an appendix has not been found. ultrasound or CT examination should not be a substitute for a good clinical history and examination. However there are many conditions, which mimic appendicitis clinically and may be diagnosed at ultrasound of the abdomen & Pelvis. It is reasonable to perform an ultrasound in young women with suspected appendicitis in order to exclude gynecological conditions. Ultrasound has not been shown to be of proven clinical benefit in some studies. Any delays in treatment while scans are being organized may have an adverse effect on the clinical outcome.

USG IN ACUTE APPENDICITIS





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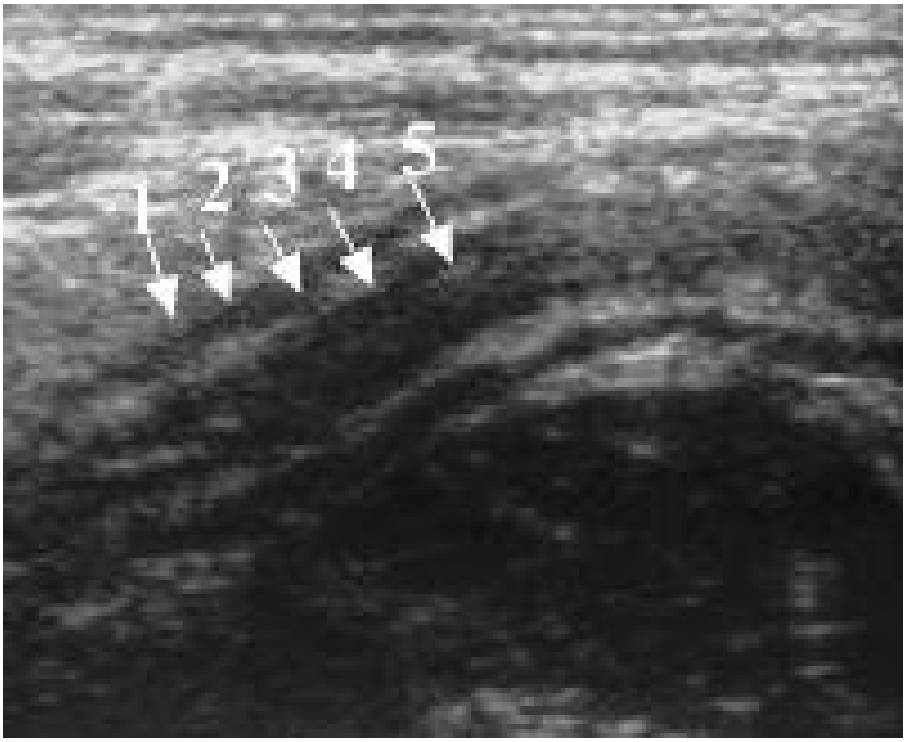
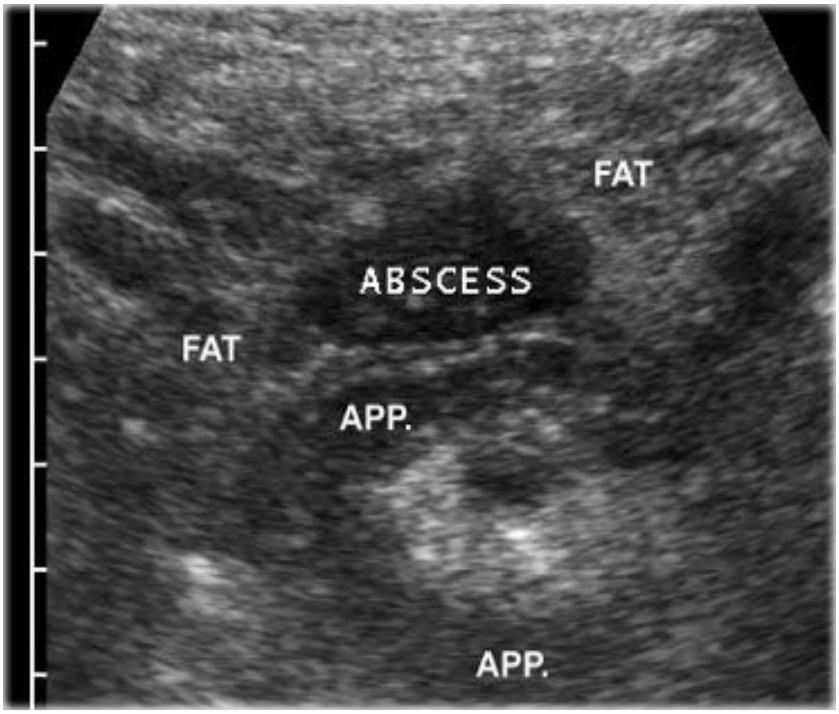




CT IN ACUTE APPENDICITIS

a) Appendix > 6mm in diameter.

b) Failure of the appendix to fill with oral contrast or air up to its tip

c) An appendicolith.

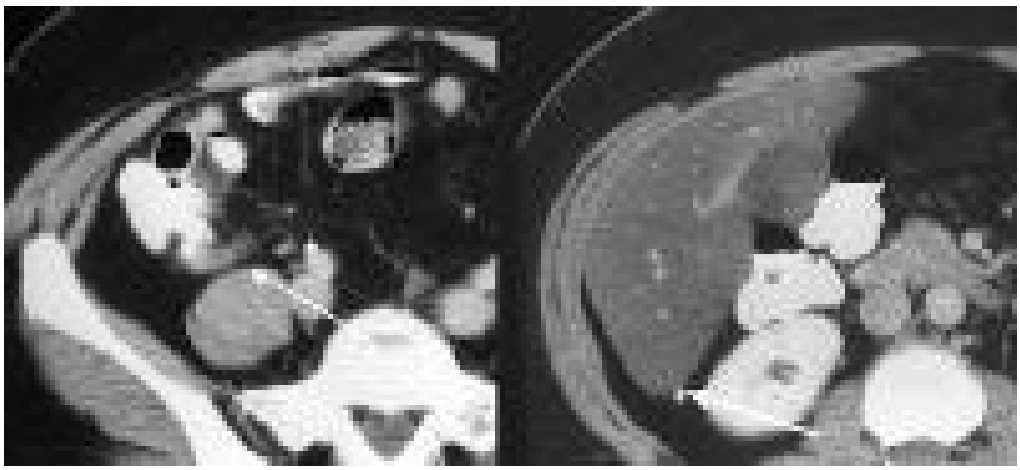
d) Enhancement of its wall with IV contrast

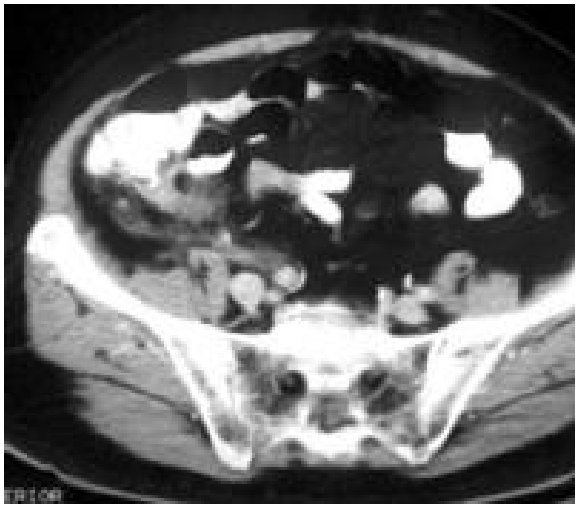
e) Surrounding inflammatory changes include increased fat attenuation, fluid, inflammatory phlegmon, caecal thickening, abscess, extraluminal gas and lymphadenopathy.

f) Sometimes the lumen of the caecum can be seen pointing towards the obstructed opening to the appendix (The “arrow- head” sign)

Spiral CT is more accurate than conventional axial scanning, and scanning with Oral and or colonic contrast is more accurate than without.

CT IN ACUTE APPENDICITIS





TREATMENT OF ACUTE APPENDICITIS

NON OPERATIVE MANAGEMENT

'TREVES' advocate early Nonoperative management of acute appendicitis, even prior to the advent of antibiotics.

In the post antibiotic era, ‘COLDREY’ presented his retrospective series of 471 patients with appendicitis treated with antibiotics. This treatment failed in at least 57 patients, 48 requiring appendicectomy, 9 requiring drainage of an appendiceal abscess.

‘ERIKSSON’ and associates in their randomized study show a high rate of recurrence of appendicitis treated non surgically.

Based on the high rate of failure with antibiotics alone, non operative management of acute appendicitis cannot be recommended.

Antibiotic treatment may be useful temporizing measure, however in environments with no surgical capabilities such as in space light & submarine travel.

OPERATIVE MANAGEMENT

PREOPERATIVE PREPARATION:

When the decision is made to perform an appendicectomy for acute appendicitis the patient should proceed to the operating room with little delay to minimize the chance of progression to perforation.

Intravenous fluids should be begun. Monitoring of pulse, Blood pressure and urine output should be done.

Severe electrolyte abnormalities are uncommon with non perforated

appendicitis, as vomiting and fever have typically been present for 24hrs or less, but may be significant in cases of perforation. Any electrolyte deficiencies should be corrected prior to the induction of general anesthesia.

Antibiotics should be administered 30 minutes prior to incision to achieve adequate tissue levels.

Acceptable antibiotics include a second generation cephalosporin or combination of antibiotics directed at gram negative and anaerobes.

OPEN APPENDICECTOMY

Appendicectomy for the free lying appendix

INCISION

1. **Classic MC Burney's Incision :**

   Made at right angles, to the point of medial two third and lateral one third along the line between the umbilicus and the anterior superior iliac spine

2. **Transverse or Rocky Davis Incision :**

   May be used at the same location

3. **Lanz incision :**

   Incision made 2-3cm medial to the anterior superior iliac spine, extended medially in the line of the skin crease over Mcburney's point

4. **The Paramedian incision :**

- less suitable
- organ is comparatively inaccessible in this approach
- Possible to contaminate the peritoneum medially in cases where the infection was strictly localized
- Valuable when the diagnosis is in doubt, Particularly in the elderly when other conditions are possible

PRINCIPLES:

The Caecum is the most lateral structure in the abdominal cavity and is the surgical target.

The skin incision is chosen to suit the situation, rather than slavishly on cosmetic grounds.

Make an adequate skin incision; properly closed, the cosmetic blemish is not related to the length. A small incision is only permissible if the caecum and appendix can be fully delivered so that the operation is conduced outside the abdomen. If intra peritoneal procedure is to be done, then access must be much more generous.

There must be no hesitation in opening the rectus sheath medially to improve the exposure.

The incision should be enlarged at the first sign of difficulty; it should be possible to remove the appendix without dragging or pulling. If the exposure

proves inadequate it is often only the muscular and facial layers that need to be further incised as the skin wound is relatively mobile.

STEPS OF OPEN APPENDICECTOMY :

The skin is incised in the chosen line and hemostasis secured. The external oblique is then nicked, and the cut end picked up with a hemostat on each side and enlarged 3cm or so in either direction. The medial hemostat is now drawn towards the midline and the areolar tissue on the inner aspect of the aponeurosis cleared. The internal oblique muscle will now be seen at its insertion into the rectus sheath, the junction of the muscle at the lateral border of the rectus is the thinnest part of the abdominal wall. A toothed dissecting forceps picks up the fibrous sheath at this point and the knife makes a small incision, carried down to the peritoneum. The lateral fibers of the rectus are just seen medially and the internal oblique and the transverses muscle can now split laterally with the fingers both in the same line. The peritoneum is picked up by two hemostats, one above and one below and incised in the line of the deep muscle split.

TECHNIQUE OF APPENDICECTOMY :

After opening the peritoneum, the caecum nearly always presents. If there is free fluid a specimen is obtained for culture. In the event, the caecum does not offer its anterior wall in to the wound , the terminal ileum is packed away

under the medial edge of the incision and the caecum sought higher and more laterally.

The caecum is next grasped by the anterior taenia between finger and thumb and then drawn first downwards and inwards and then upwards over the medial portion of the wound.

As it is delivered it is seized with a moist pack and progressively turned towards the left. The appendix comes into view. The right index finger may be inserted in to the wound to aid the gentle delivery of the organ, but only under vision.

If is advisable to use the tissue holding forceps (Babcock's) to grasp the appendix.

A more generally applicable manoeuvre is to seize the mesoappendix in a curved artery forceps.

The next step is to divide any bloodless peritoneal attachments to the right of the mesoappendix, allowing this structure to be more easily seen.

The mesoappendix may be serially clipped and cut until its base is reached or if the mesoappendix is well defined, a single ligature may be passed around it and tied.

The appendix is now free and unencumbered by instruments except for the one forceps at its tip. A hemostat is applied across its base, then moved distally one diameter, applied again and finally applied for a third time the same

distance along the appendix. The organ is ligated across the first crush and will be cut through the second.

Residual appendiceal stump should be no longer than 3cm to minimize the possibility of stump appendicitis in the future.

Much debate has gone for years about whether or not to invaginate the appendix stump.

Appendicular stump abscess in the caecal wall is so rare that it should not be regarded as a contraindication to invagination. In that the gut heals best by the formation of granulation tissue and collagen from serosal layers, it seems rational to invaginate.

Invagination is done using either purse string or z- stitch suture placed at least 1.5 cm away from the stump. If the caecal wall is oedematous, one must not attempt invagination. The appendix base is cut with knife.

The tension on the caecum is now relaxed and the line of the mesoappendix checked for bleeding. If all is well the caecum is allowed to fall back into the wound.

Following is carried out if the appendix is with doubt.

I. In a female, Palpate right ovary and tube. The glove is examined for blood.

II. The last meter of the ileum is withdrawn to

- See for mesenteric nodes
- Meckel's diverticulam

- Reasonabley certain that there are no other lesions

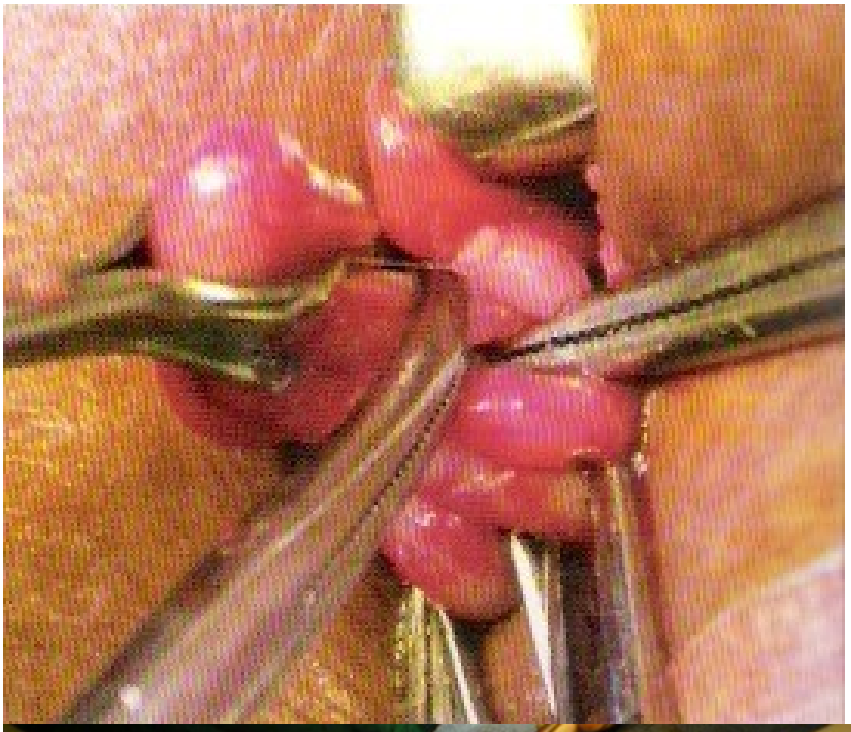
III. A finger is passed to the left and downwards to seek the inflammed loop of sigmoid colon which is a seat of diverticular disease.

STEPS IN OPEN APPENDICECTOMY

External Oblique Aponeurosis Opened

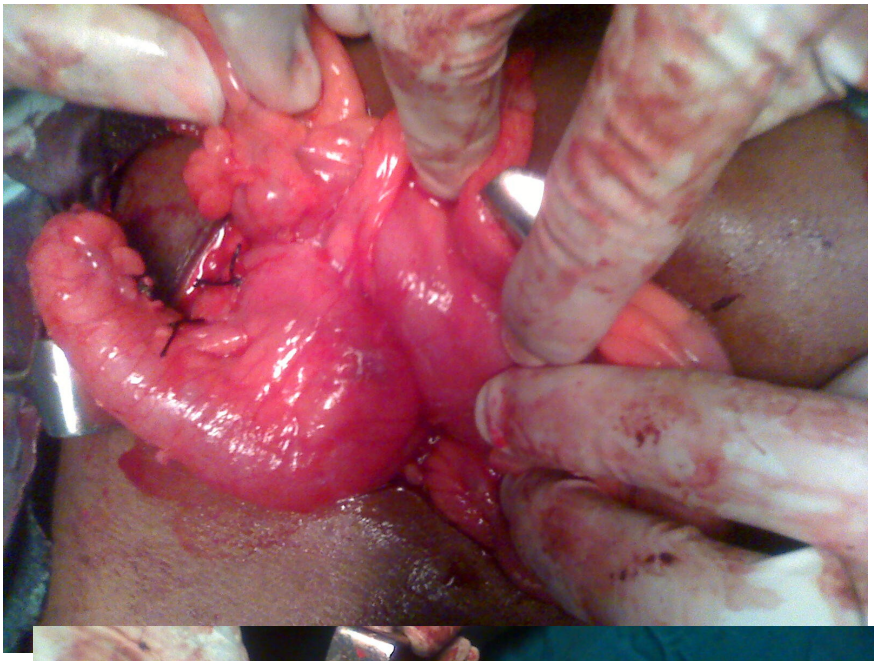
Peritoneum opened

Appendix delivered



Appendix delivered

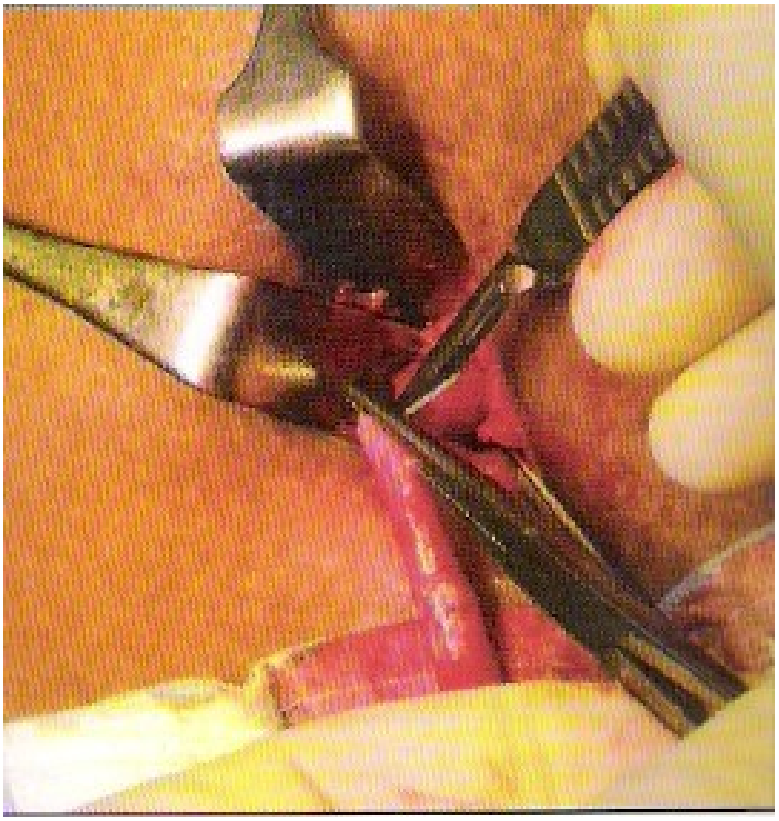
Division of Mesoappendix



Division of Mesoappendix

Division of Mesoappendix

Division of inflammed appendix



Excised appendix

PROBLEMS :

1. **The caecum cannot be found**.
    - Either not descended fully or malrotation of the intestine
    - Extension of the incision upward
2. **Caecum cannot be delivered :**
    - Adequate access and vision. The peritoneal reflection around the lower pole may be divided bearing in mind, gonadal vessels & ureter lie medially just deep to the peritoneum
3. **Appendix cannot be found :**
    - Make certain that it is the caecum that has been delivered.

    Transverse colon recognised by attachment of greater omentum,

sigmoid colon by appendices epiploicae.

- Trace the taeniacoli of the caeeum, leads to the base of the appendix. Back or undersurface of the caecum palpated, the appendix may be buried in the caecal wall.
- If previous appendicectomy excluded, only possibility is, organ has become inverted (or) intussuscepted.

4. **Appendix has sloughed off** :

- The mesoappendix anchors the organ in the field of operation
- It may be in 2 portions if a faecolith has perforated through the wall.
- Both portions must be removed and the faecolith retrieved usually from the pelvis.

5 .**The appendix lies Buried Retrocaecally** :

- Enlarge the wound
- Caecum is retracted to the left.
- Reflection of the peritoneum on the lateral aspect of the caecum is in view, a hockey- stick shaped incision is made in the parietal peritoneum, after a little blunt dissection, in the retroperitoneal space the caecum can be retracted still further to the left rendered far more mobile and rotated, the combined effects of which result in bringing the greater portion of a hidden appendix.

6. Appendix clothed with adherent Greater omentum:

- Not to disturb adherent omentum, when within it lies a gangrenous or perforated appendix.
- Greater omentum divided between hemostats at a convenient distance from the appendix and then appendicectomy conducted.

7. Appendix is gangrenous near its junction with caecum

- Possibility of sudden gush of liquid faeces from the caecum, to avoid this, if the caecum is ballooned deflate the caecum before appendicectomy.
- The method of closing the stump is, by two sutures transfixing the caecal wall. These must be inserted before the appendix is amputated and are later oversewn by interrupted seromuscular sutures.

8. The mesoappendix is gangrenous and cuts out

- If a ligature will not hold, a stitch applied directly beneath a spurting vessel may stop the bleeding.

RETROGRADE APPENDICECTOMY :

Indication

- Base of the appendix is accessible and difficulty is experienced in identifying or delivering the distal part of the organ completely.
- In Retrocaecal appendicitis

Technique :

- Base of the appendix is held between finger and thumb so that its junction with caecal wall apparent.
- Fine hemostat passed between caecum and appendix to create a space and 2 simlar instruments are applied across the appendix, which is divided between them
- The mesoappendix is then clamped & divided working distally.
- Purse string suture is inserted with the hemostat grasps the stump.
- Appendicular stump ligated.
- Base of the appendix buried

Closure :

- There is no absolute need to close the peritoneum separately
- Transverse slit in the peritoneum and deep muscle may be closed as one layer with either continuous or interrupted absorbable ‘o’ gauge or nil gauge
- A muscle cutting incision should be closed with continuous or interrupted absorbable monofilament sutures.
- Skin closed with fine, interrupted monofilament sutures or clips

POST OPERATIVE COMPLICATIONS

Occur in 5% of patients with the unperforated appendix, but in more than 30% of the patients with a gangrenous (or) perforated appendix.

Most frequent complications

a) Wound infection

b) Intra abdominal abscess

c) Faecal fistula

d) Pylephlebitis

e) Intestinal obstruction

A) Wound Infection

- Anaerobic bacteroides species, Aerobes klebsiella, Enterobacter, E. Coli
- Early signs of wound infection (Undue pain & Edema) are present
- wound should be opened and packed with saline soaked gauze and reclosed with steri strips in 4-5 days.

B) Intra abdominal abscesses

- Pelvic, subphrenic (or) intraabdominal abscesses Occur in upto 20% of pts with gangrenous (or) perforated appendicitis.
- Recurrent fever, malaise and anorexia of insidious onset
- CT Scan is of help in diagnosing intraabdminal abscess

- When an abscess is diagnosed it should be drained ether operatively (or) Percutaneously.

C) Faecal Fistula

Some close spontaneously, provided that there is no anatomic reason for the fistula remaining open. Those that do not close spontaneously require operation.

D) Pylephlebitis or Portal pyaemia

- Characterized by jaundice, chills & high fever it is a serious illness that leads to multiple liver abscesses.
- The infesting organism is usually E.coli
- This complication becomes rare with routine use of antibiotics in complicated appendicitis.

E) Intestinal Obstruction

- Although not infrequent true mechanical bowel obstruction may occur as a complication of acute appendicitis
- Operative therapy is indicated as any other mechanical small bowel obstruction.

ALVARADO SCORE

SYMPTOMS :

1. Migrating right iliac fossa pain	:	1
2. Anorexia	:	1
3. Nausea / Vomiting	:	1

SIGNS :

1. Tenderness – right iliac fossa	:	2
2. Rebound tenderness	:	1
3. Elevated Temperature	:	1

LABORATORY TEST :

1. Leukocytosis	:	2
2. Shift to Left	:	1
TOTAL SCORE	**:**	**10**

Later it was modified by kalen et al who excluded shift to left, since it is not available all the times & the score becomes 9.

THE MODIFIED ALVARODO SCORE

SYMPTOMS:

1. Migrating right iliac fossa pain	:	1
2. Anorexia	:	1
3. Nausea / Vomiting	:	1

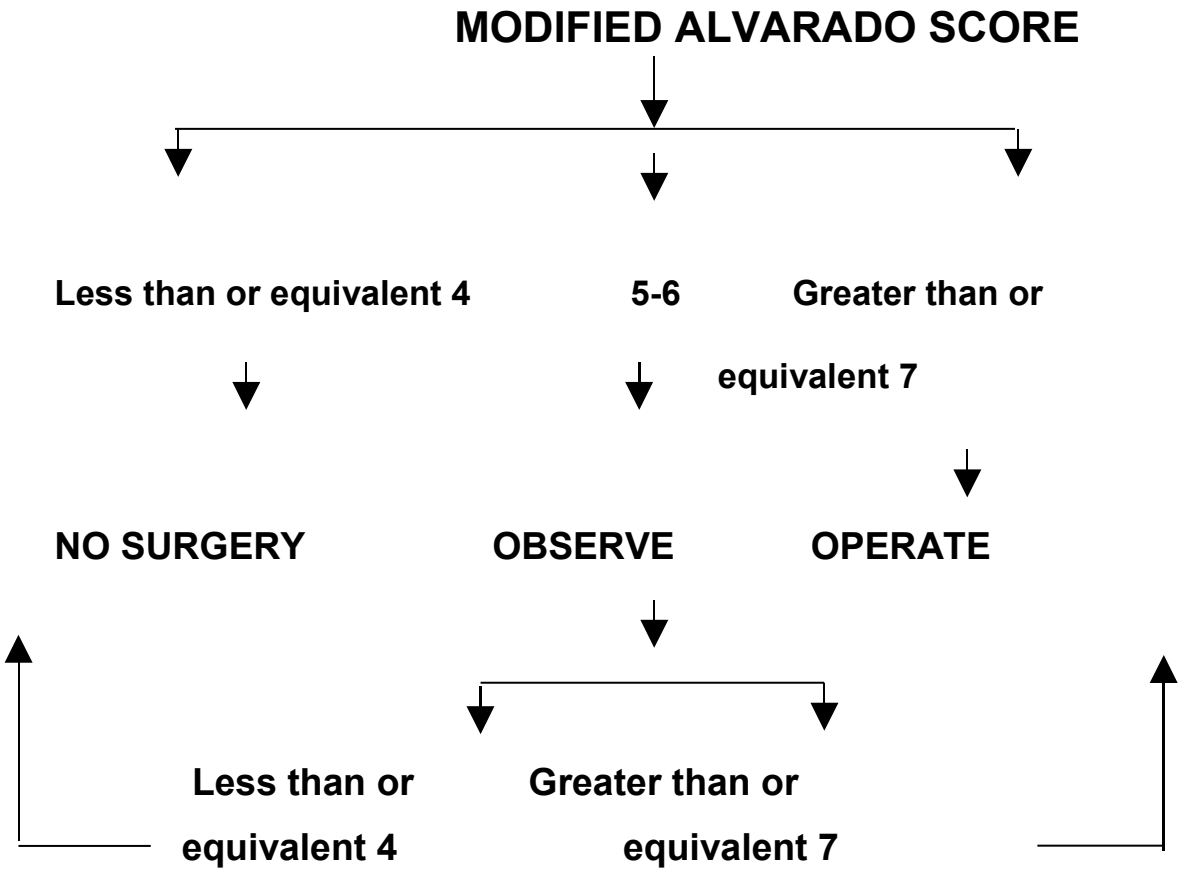
SIGNS:

1. Tenderness –right iliac fossa	:	2
2. Rebound tenderness	:	1
3. Elevated Temperature	:	1

LABORATORY TEST:

Leukocytosis	:	2

TOTAL SCORE	**:**	**9**


MODIFIED ALVARADO SCORE
Less than or equivalent 4
5-6
Greater than or equivalent 7
NO SURGERY
OBSERVE
OPERATE
Less than or equivalent 4
Greater than or equivalent 7

OBSERVATIONS & RESULTS

Total No of patients with suspected appendicits	:	120
Patients with score > 7 _	:	98
Patients with Score 5-6	:	10
Patients with < 4 _	:	12
No. of Patients whose score increased to > 7 During Period of observation	:	6
No. of patients whose score decreased to < 4 during Period of observation	:	4
No.of Patients who underwent Appendicectomy	:	104
No.of Patients who did not undergo Appendicectomy	:	16
Histopathologically positive Appendicitis	:	101
No.of patients who had normal Appendix	:	3
Patients with Score < 4 but developed Appendicitis	:	3

Alvarado Scoring Results	Appendicitis (HPE +ve)	Normal appendix	Total
+ve	101	3	104

-ve	3	13	16
Total	104	16	120

Sensitivity of the Test = 101 / 120 x 100

= 84.26%

Specificity of the Test = 13/120 x 100

= 10.83%

Positive Predictive Value = 84.26%

Negative Appendicectomy Rate = $\frac{\text{Histopathologically(-Ve) Cases}}{\text{Total no of appendicectomies}}$

= 3/104 x 100

= 2.8%

Missed appendicitis Rate = $\frac{\text{No of Missed cases of appendicitis}}{\text{Total number of suspected cases}}$

= 3/120 x 100

= 2.5%

RESULTS FOR MALE PATIENTS

Total no. Of patients with suspected appendicitis : 60

Patients with score > 7	:	50
Patients with score 5-6	:	5
Patients with score ≤ 4	:	5
No. of Patients whose Score increased to > 7 during Period of observation	:	3
No. of Patients whose score decreased to < 4 during Period of observation	:	2
No. of Patients underwent Appendicectomy	:	53
No. of Patients who did not undergo Appendicectomy	:	7
Histopathologically positive appendicitis	:	52
No. of Patients who had normal appendix	:	1
Patients with score < 4 but developed Appendicitis	:	1

Alvarado Scoring results	**Appendicitis (HPE + ve)**	**Normal appendix**	**Total**

+ve	52	1	53
-ve	1	6	7
Total	53	7	60

Sensitivity of the Test = 52/60 x 100

= 86.66%

Specificity of the Test = 6/60 x 100

= 10.0%

Positive Predictive Value = 86.66%

Negative Appendicectomy Rate = $\frac{\text{Histopathologically (-ve) cases}}{\text{Total no of appendicectomies}}$

= 1/53 x 100

= 1.8%

Missed appendicitis rate = $\frac{\text{No of missed cases of appendicitis}}{\text{Total no of suspected cases}}$

= 1/60 x 100

= 1.6%

RESULTS FOR FEMALE PATIENTS

Total no. Of Patients with suspected appendicitis : 60 Patients with score > 7 : 48

Patients with Score 5–6 : 5

Patients with Score < 4 : 7

No. of Patients whose score increased to > 7 during Period of observation : 3

No. of Patients whose score decreased to < 4 during Period of observation : 2

No. Of Patients who underwent Appendicectomy : 51

No. Of Patients who did not undergo Appendicectomy : 9

Histopathologically positive Appendicitis : 49

No. Of Patients who had normal appendix : 2

Patients with Score < 4 but developed appendicitis : 2

Alvarado Scoring results	**Appendicitis (HPE +ve)**	**Normal appendix**	**Total**
+ve	49	2	51
-ve	2	7	9
Total	51	9	60

Sensitivity of the Test = 49/60 x 100

= 81.66%

Specificity of the Test = 7/60 x 100

= 11.66%

Positive Predictive Value = 81.66%

Negative appendicectomy Rate = $\frac{\text{Histopathologically (-ve) Cases}}{\text{Total number of appendicectomies}}$

= 2/51 x 100

= 3.9%

Missed appendicitis Rate = $\frac{\text{No. of Missed cases of appendicitis}}{\text{Total number of suspected cases}}$

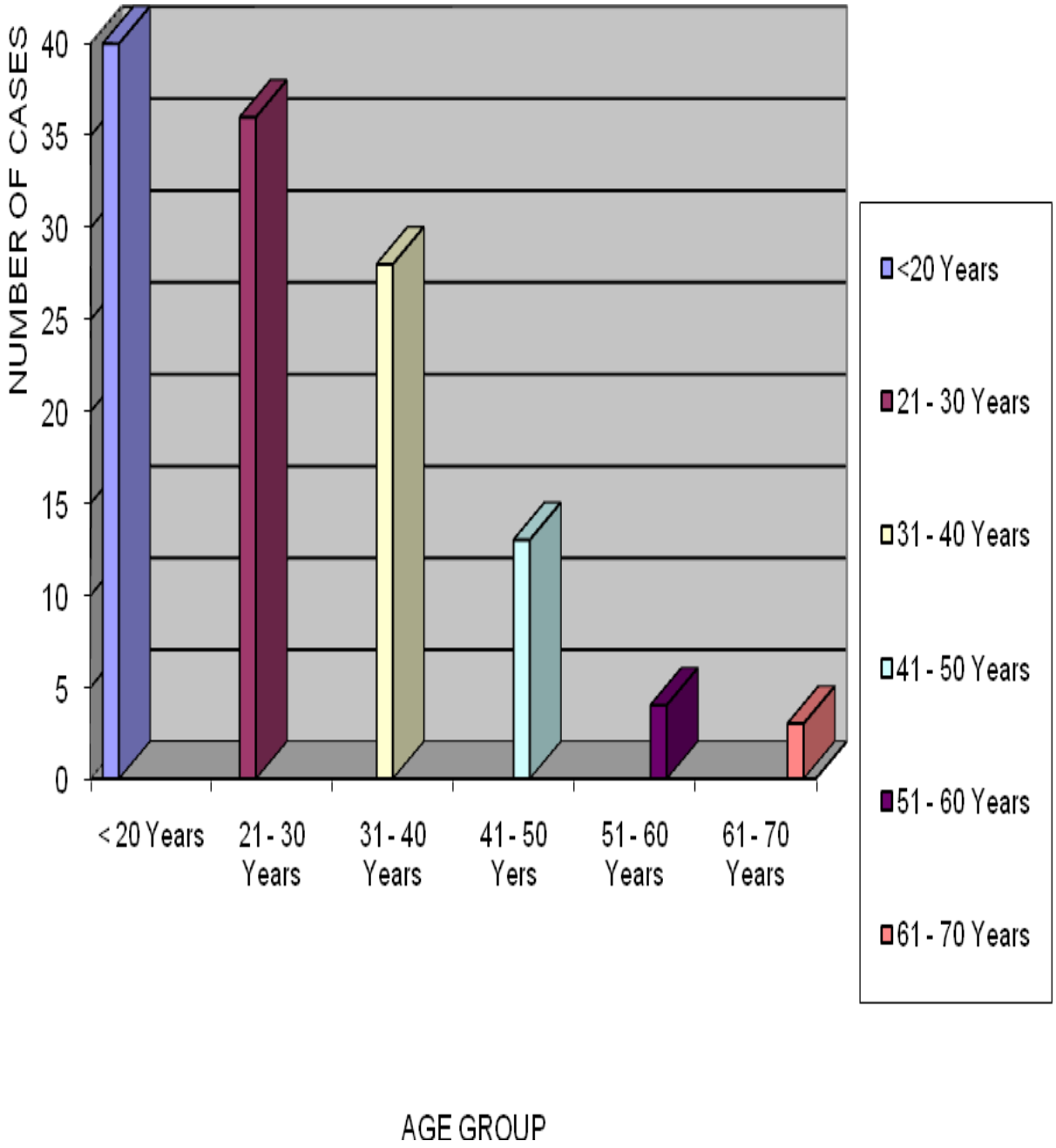
= 2 /60 x 100

= 3.3%

MODIFIED ALVARADO SCORING SYSTEM

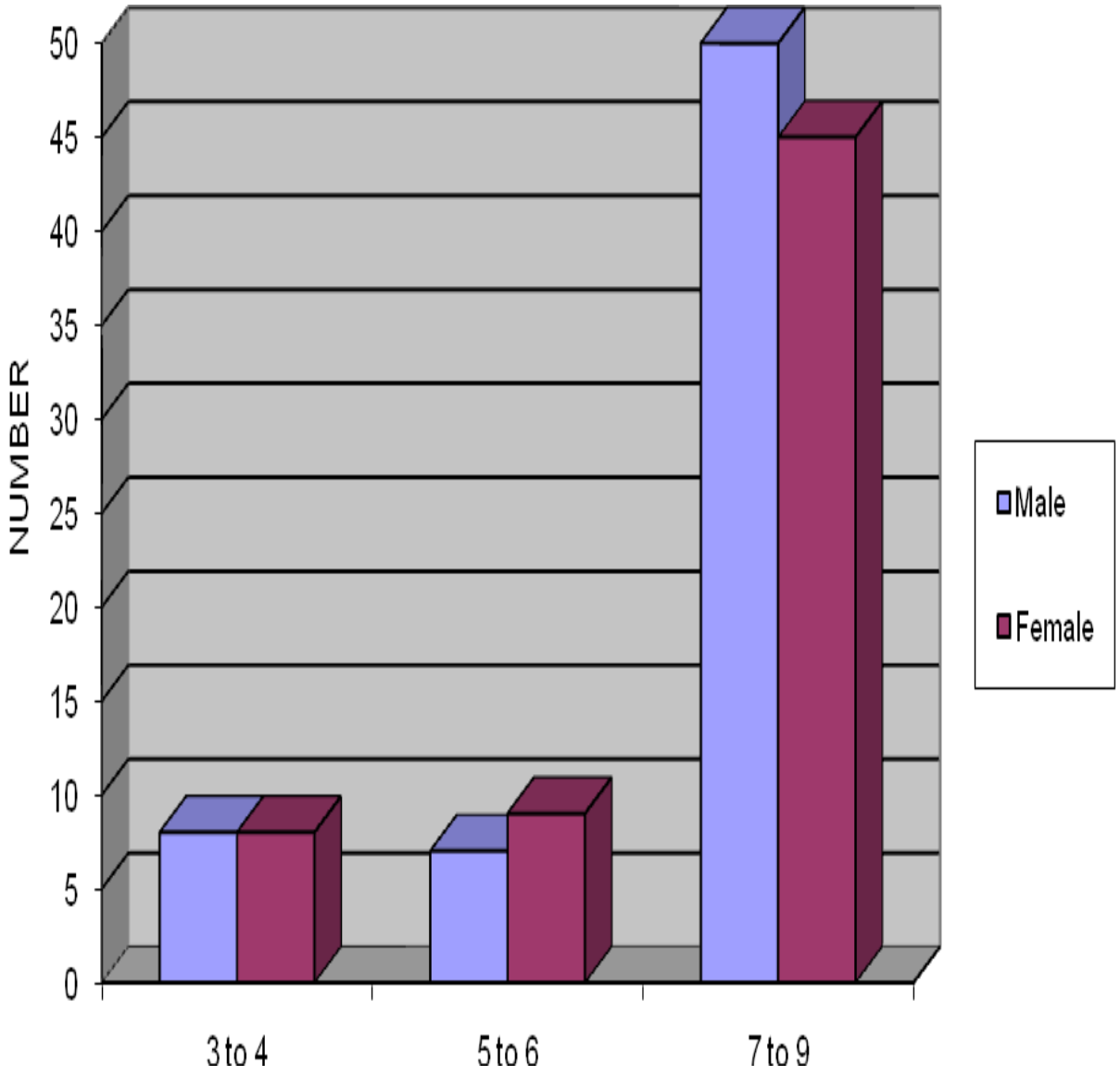
CHARTS

Age wise distribution



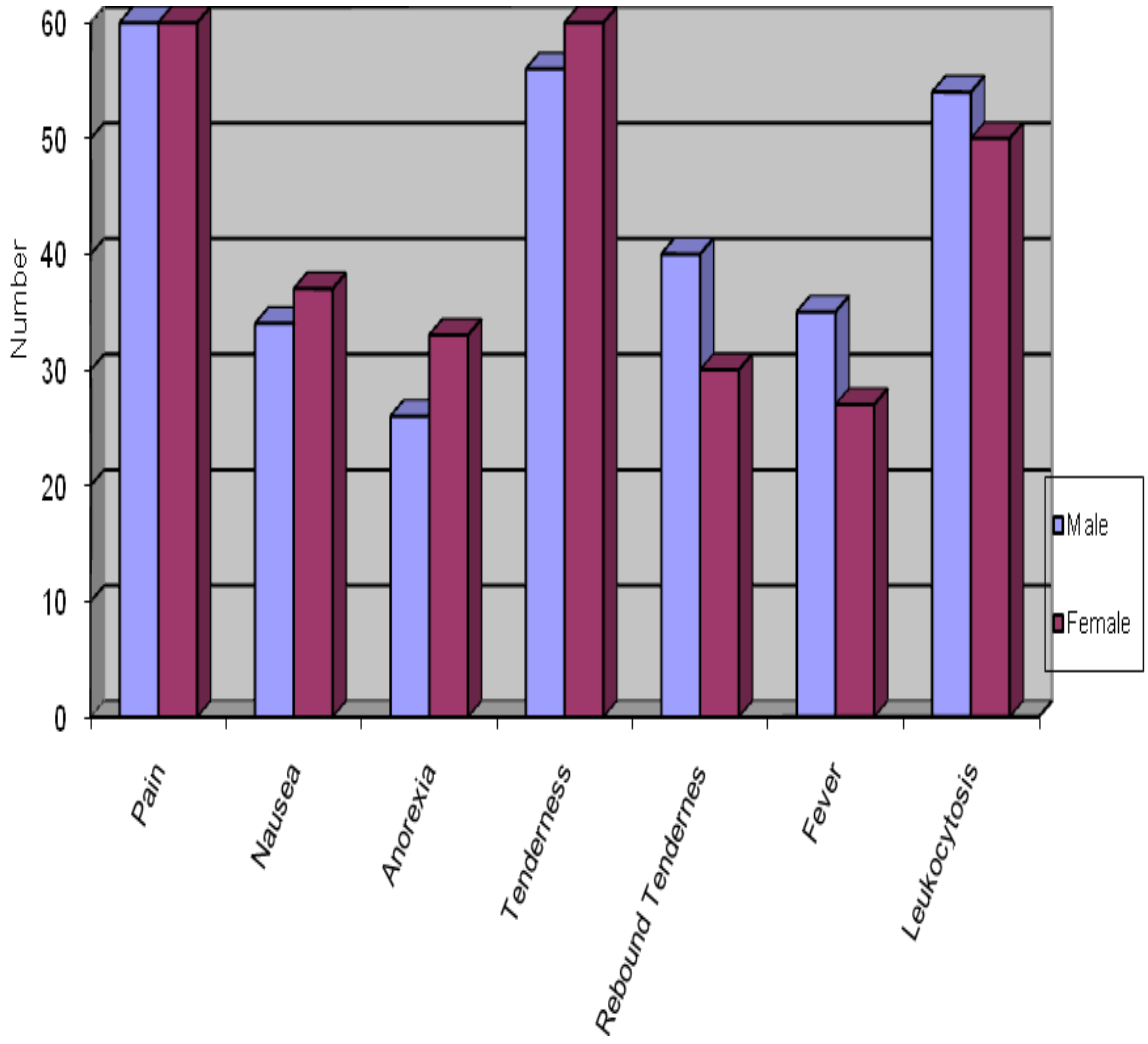
MODIFIED ALVARADO SCORING SYSTEM

Alvarado scoring Vs number of cases



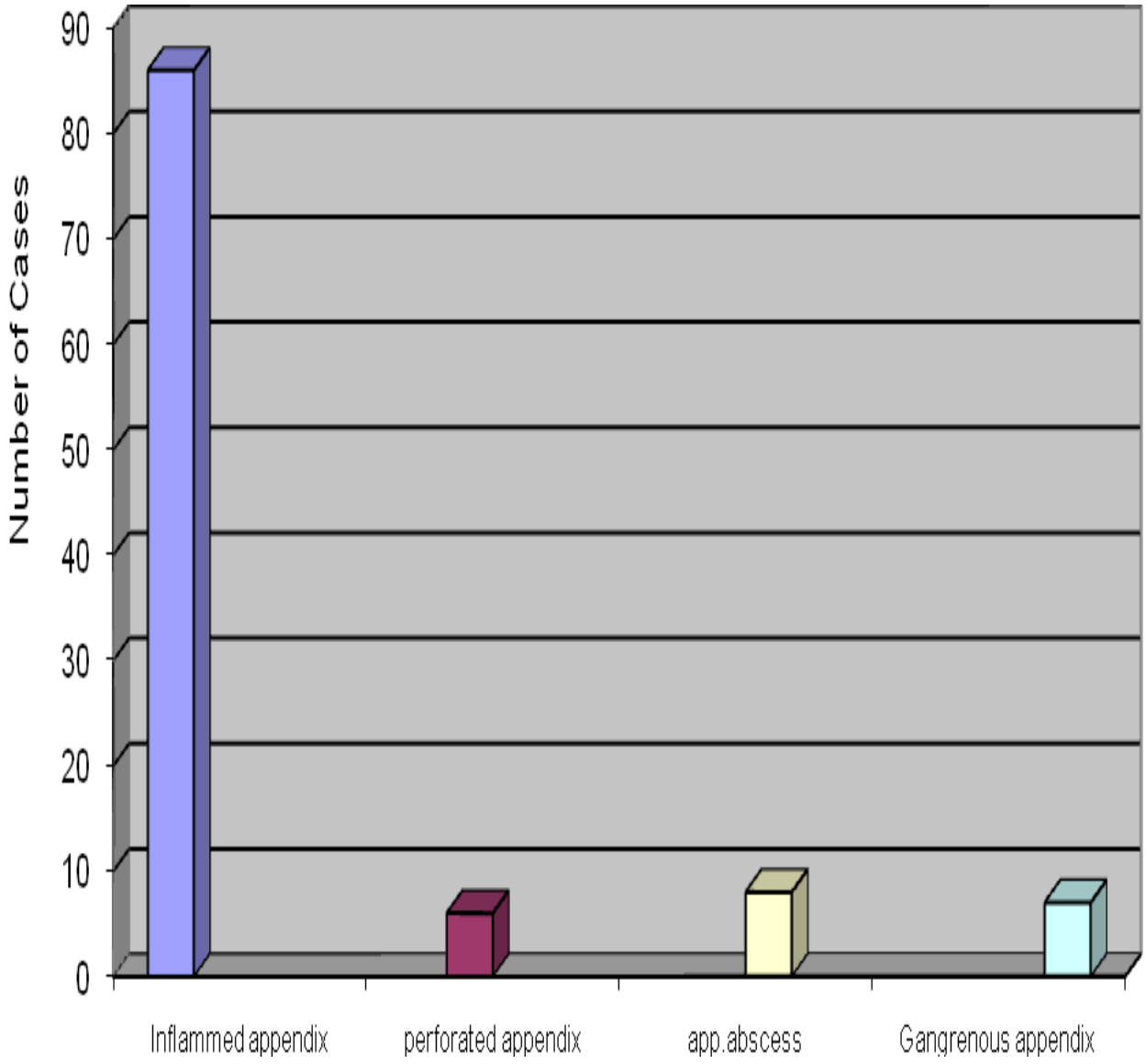
MODIFIED ALVARADO SCORING SYSTEM

Variables Vs number of cases

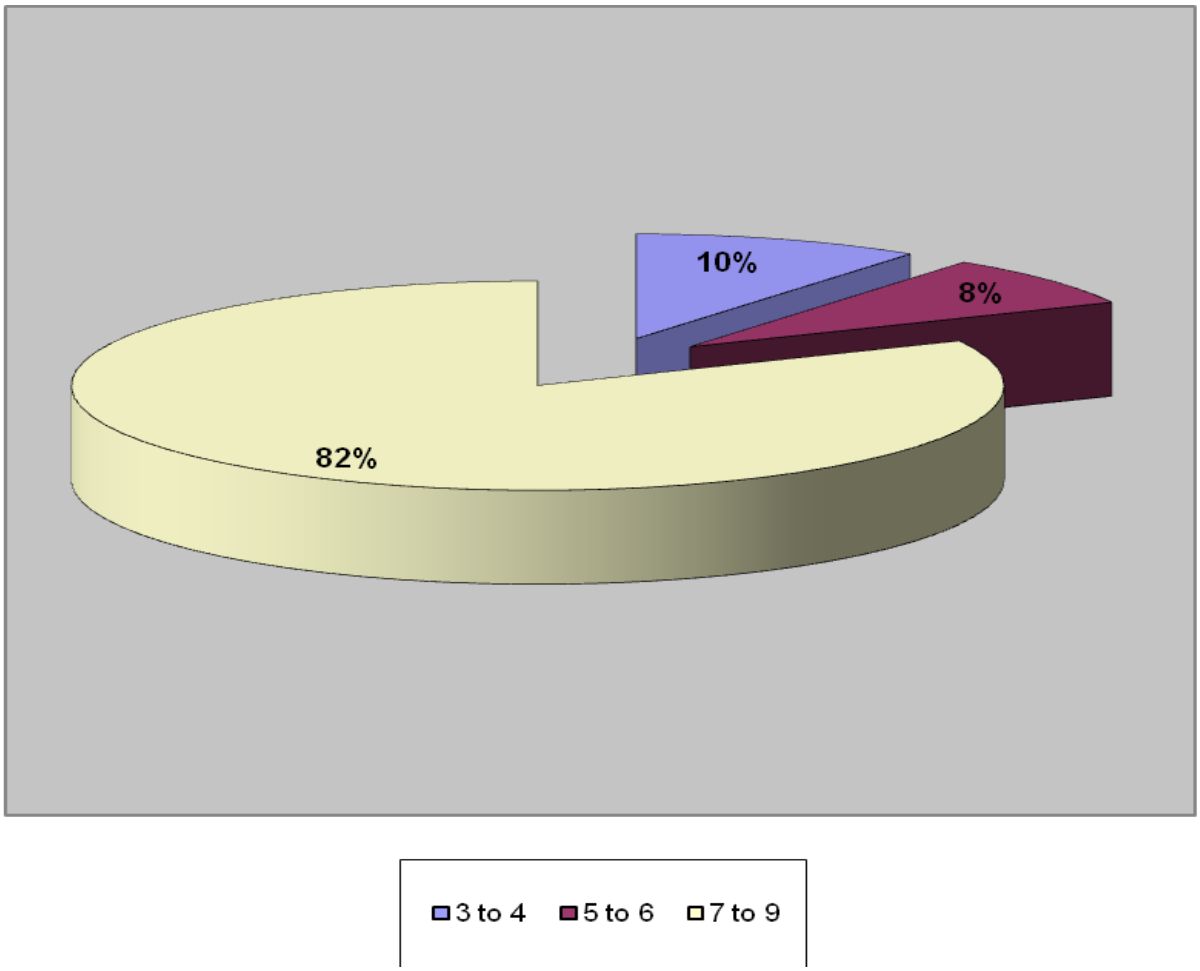


MODIFIED ALVARADO SCORING SYSTEM

Intraoperative findings



MODIFIED ALVARADO SCORING SYSTEM



DISCUSSION

The diagnosis of acute appendicitis continues to be difficult due to the variable presentation of the disease and the lack of reliable diagnostic test. Although there has been some improvement in the diagnosis of acute appendicitis over the past several decades, the percentage of normal appendices reported in various series varies from 8 to 33%.

Clinical Scoring systems have proved useful in the management of number of surgical conditions. In the past few years various scores have been developed to aid the diagnosis of acute appendicitis. Although many diagnostic scoring have been described, those are difficunt to implement in the clinical situations. The modified Alvarado score, is a simple scoring system that can be instituted easily.

In a prospective study of 215 adults and children in Cardiff, use of the Alvarado score decreased an unusually high false-positive Appendicectomy rate of 44% to 14%. 18 Fenyo 11, reported in one study a sensitivity of 90.l2% and specificity of 91.4% and others reported a sensitivity of 73%, specificity of 87% with negative appendicectomy rate of 17.5%.

To be useful, a scoring system must be both sensitive and specific. The Modified Alvarado score proved to be effective in adult male patients with acute appendicitis but not useful to the same extent in females of reproductive age group.

Our study demonstrates that Modified Alvarado score is substantially superior in diagnosis of Acute Appendicitis in adult with a sensitivity of 84.26% and a specificity of 10.83%. For male patients sensitivity of 86.66%, specificity of 10.0%. For female patients sensitivity of 81.66%, specificity of 11.66%. The Alvarado score is both simple to remember and to use. This Scoring system seems ideal for the diagnosis of Acute Appendicitis because it is non-invasive, requires no special equipment and can be easily used by a JUNIOR RESIDENT as clinical routine in a peripheral hospital.

Negative Appendicectomy rate in this study is 2.8% where as in general the negative Appendicectomy rate reported in literature is 15-30% thus it grossly reduces the negative Appendicectomy rates. In comparison the abdominal ultrasound has shown results with an average sensitivity of 86% and a specificity of 94% under the condition of well-controlled clinical trials, namely in the hands of experienced person.

CT Scans have excellent Sensitivity and specificity, ranging 87-100% and 91-97% respectively.

Leukocyte count has a sensitivity of 85% and abdominal radiography 40%.

BUT,

Abdominal ultrasound requires special equipment and it is operator

dependant.

Computed Tomography is expensive and not readily available everywhere.

It is the same with radioisotope studies. Abdominal X-Ray is of limited used and has the risk of radiation exposure.

In our study (98/120) 81.66% presented with a score of > 7 of the remaining 10 observed 4 had a score of > 7 within 6 hours and 2 within 12 hours. The remaining 5 persons who were observed did not have an increase in the score further. So 85% of Appendicectomies can be clinically decided within first 6 hours.

Of the 12 who had a score of < 4, 3 developed acute appendicitis at a later date.

Missed Appendicectomy rate is 2.5%. Better clinical experience and recent radiological investigation may reduce this value.

SUMMARY AND CONCLUSION

CONCLUSION

Modified Alvarado Scoring system with a diagnostic accuracy of 97% seems to be ideal for supporting the diagnosis of acute appendicitis because it is noninvasive, does not require special equipments, and is simple to remember, and use in a peripheral set up by a junior resident where radiological investigation are difficult to perform.

The sensitivity and specificity of the test is good for the male population compared with the females. This can be easily attributed to the pelvic pathological conditions which require a diagnostic ultrasound in addition.

In conclusion Modified Alvarado scoring along with an abdominal and pelvic ultrasound may be the ideal tool to diagnose acute appendicitis in males.

Acute appendicitis is a common cause of abdominal pain in patients attending emergency departments. Nevertheless, a correct diagnosis based on Clinical and laboratory findings is not easy.

Promising results have been published for the use of ultrasonography and

to inquire the diagnostic accuracy. However, these investigations are highly investigator dependant or they involve exposure to radiation, respectively.

History taking and physical examination on the other hand require no special equipment and are readily available.

It is also conceivable that imaging techniques will gain wider acceptance, but careful history taking and clinical diagnosis are important measures.

(i) Determining which patients would benefit from these investigation, and

(ii) Providing the clinical contest that is necessary for correct interpretation of imaging findings.

PROFORMA

Name : DOA :

Age : DOS :

Sex : DOD :

Clinical Presentation :

Symptoms :

Migrating right iliac fossa pain

Anorexia

Nausea

Vomiting

Signs:

Fever

RIF tenderness

Rebound tenderness

Investigation:

Hb Blood sugar

Total leucoyte count Blood urea

Differential count Sr.Creatinine

Differential count ESR Sr.Electrolytes

Chest X Ray Abdominal X Ray

INTRA OPERATIVE FINDING

1. Position of appendix
2. Gangrene
3. Abscess
4. Perforation

Histopathological report :

Post Operative follow up :

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MASTER CHART

S.No.	NAME	AGE	SEX	I.P NO	PAIN	NAUS-EA	ANOREXIA	TENDERNESS	REBOUND TENDERNESS	FEVER	LEUKOCYTOSIS	MASS	APPENDICULAR GANGRENE & PERFORATION	APPENDICULAR ABSCESS	INFLAMMED APPENDIX
1.	Naveen	12	M	39529	+	+	+	+	+	+	+	9	+		
2.	Rajesh	24	M	39425	+	+	+	+	+	+	+	9	+		
3.	Kumar	33	M	41049	+		-	+	+	+	+	7			+
4.	Geetha	25	F	41094	+	+	+	+	+		+	8			+
5.	Anjali devi	18	F	39414	+	+	+	+	+		+	8			+
6.	Thaluath	40	F	39450	+	+	+	+			+	7			+
7.	Nalina	38	F	40928	+	+	+	+			+	7			+
8.	Saravanan	38	M	39369	+	+	+	+	+	+	+	9			+
9.	Probhakaran	25	M	39410	+	+	+	+	+	+	+	9	+		
10.	Divya	10	F	38887	+	+	+	+	+		+	8			+
11.	Deepika	13	F	38366	+	+	+	+	+		+	8			+
12.	Arulmani	39	F	32195	+	+						2			
13.	Ramesh	40	M	38228	+	+	+	+			+	7			+
14.	Suseela	31	F	38167	+		+					2			
15.	Ashok Kumar	14	M	38185	+	+	+	+	+	+	+	9	+		
16.	Aasarthaliyan	13	M	37715	+	+	+	+	+	+	+	9	+		
17.	Baskaran	35	M	37158	+	+		+	+	+	+	8			+
18.	Vijaya kumar	11	M	36914	+	+		+	+	+	+	8			+
19.	Mallika	30	F	38380	+	+		+		+	+	7			+
20.	Mallika	48	F	36021	+			+			+	5			+
21.	Jothi	35	F	36102	+	+	+	+		+	+	8			+
22.	Gayathri	15	F	36918	+			+				3			
23.	Anbu	14	M	36258	+	+	+	+	+	+	+	9			+
24.	Rubos	16	M	36780	+			+	+	+	+	7			+
25.	Senthil Kumar	38	M	36779	+	+	+	+	+	+	+	9		+	
26.	Arun	39	M	36602	+			+	+	+	+	7			+